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## THE UTILITY OF SEA-FISH HATCHING



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*Director of the Marine Fish Hatchery  
at Flödevig, Norway*



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## THE UTILITY OF SEA-FISH HATCHING.

By G. M. DANNEVIG,

*Director of the Marine Fish Hatchery at Flödevig, Norway.*

From the middle of the last century the shore fisheries on the south coast of Norway were steadily decreasing, and principally was this the case with cod and flatfish. The cause of the decline was commonly supposed to be overfishing and especially the excessive use of small ground seines, by which the bays and the small patches of clean ground adjacent to the coast were continually swept.

In the beginning of the eighties the state of things became serious. The fishermen as well as the public in general complained loudly, and several modes of protecting the fisheries were proposed. At this period the Arendal Fisheries Society was founded, and being informed that the Fish Commission of the United States had succeeded in hatching cod eggs, it was decided to try this expedient as the only one available that could be used without inconvenience to the fishermen. Consequently a small hatchery for cod was started and maintained for four years, chiefly by private contributions. As an evidence of the great interest in behalf of the enterprise, it can be mentioned that the inhabitants of Arendal, a small place with less than 5,000 souls, during the first five years contributed 24,232 kroner (equal to \$6,550) toward the hatchery.

Operations began in 1884 and, as was expected, spawning fish were very scarce and difficult to obtain. The fish market at Arendal was visited almost every day from the beginning of January to the end of March, and the whole quantity of spawn collected was only 28 liters. The next year a small well-boat was provided for buying up spawners on the coast between Bisor and Homburgsund, a distance of about 40 miles, but with no great success, the whole amount of spawn for the following three years being respectively 109, 153, and 144 liters. In 1888 no fish could be had, on account of the ice blockading the coast, and in 1889 no work was done, as the station then was undergoing reconstruction, it having been found desirable to have it removed to another site and enlarged. In 1890 the new hatchery was started with 42 hatching apparatus against 9 in the preceding years, and as there was no chance of getting a full complement of spawners in Arendal or the neighborhood, a well-smack was dispatched



for that purpose. In 1891 there was a marked increase in the cod fishery near Arendal, and still more so in 1892, so that a considerable part of the spawners could be bought there. In 1893 the whole number of spawners was obtained in Arendal, and the spawn collected amounted to 1,000 liters. From that year to the present time there has been no lack of spawners at the Arendal fish market, and the quantity of spawn each year has varied between 550 and 1,326 liters, not according to what could be had, but according to the sum voted by the Storthing for the hatchery. At present it would not be difficult to obtain 2,000 liters if required. It must be borne in mind, however, that natural spawning, introduced in 1890, produces at least double the quantity of spawn compared to the old method, and that consequently the number of spawners can not be calculated direct from the quantity of spawn; but on the other hand it is obvious that the cod has increased greatly in the vicinity since the hatchery was started.

As mentioned above, the hatchery was started in 1884. That year a small quantity of fry, less than 1,000,000, was planted in a small fjord about 10 miles from Arendal. In the following year the neighboring people sent me a letter with the information that a great many small cod had made their appearance, in fact more than the oldest inhabitant could remember.

In 1889 the Bergen Society for the Promotion of the Norwegian Fisheries sent one of their chief members, the president of the propagation committee, as well as the state inspector of fisheries, to the fjord in question to investigate the matter. Their report, dated March, 1889, says that there is no doubt that the number of cod in the fjord has increased and that this is the result of the planting of the fry, and, further, that there can hardly be any doubt that artificial hatching is the right course to take to improve the fisheries.

In 1895 the Storthing decided that to get further proof of the utility of sea-fish hatching fry should be planted in inclosed fjords in the same manner as before and without previous investigations. This was done, and in conformity with the plan adopted our society approached the public where fry had been planted in former years and asked their opinion as to the results. Twenty-two answers came in from parish councils, commercial marine societies, and from private parties and fishermen. The answers were unanimous, and to the effect that an unusual number of small cod made their appearance wherever fry were planted, and, further, that the fish to a great extent were of a color differing from that of the local race.<sup>a</sup>

These documents, however, when laid before the Storthing, caused a member opposed to sea-fish hatching to express a doubt as to their trustworthiness,

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<sup>a</sup> The cod on the south coast of Norway vary greatly as far as color is concerned, there being light gray, dark gray, red, and yellow cod, according to race, nature of bottom, food, etc., and, generally speaking, each fjord or stretch of coast has its own peculiar variety.



and the Government ordered its adviser in fishery questions to investigate the matter. His report, dated December, 1896, contains the following particulars: He had visited the principal places where fry had been planted between Fredriksald and Arendal, a distance of about 150 miles, and had questioned fishermen and others, especially such as had not signed the documents. He had in most cases avoided making himself known, pretending to be a private individual who took an interest in the question, and thinks therefore that he got explicit and unreserved answers. Out of thirty persons with whom he had conferred, there were twenty-five who were of a decided opinion that the planting of fry had caused a more or less considerable increase in the number of cod, two who thought there was but a slight increase, and three who had observed no increase at all. In many places the people were certain that they could distinguish the broods planted in the different years and that the size corresponded with the age. The cod now were partly of a color different from what they used to be. He also found the inhabitants very eager to have more fry planted in their fjords, even if they should have to pay for it out of their own pockets.

Since then our society has received a great many testimonials of the same tenor (60 altogether) and as they have been accompanied with cash to the amount of 10,000 kroner for fry delivered, their trustworthiness can hardly be doubted.

In 1903, the Storthing, still doubtful, voted the necessary sums for the investigation of fjords where fry were to be planted. The plan was to have them thoroughly overhauled before and after fry were put in, with the object of ascertaining the approximate number of cod of the year's growth. A seine with very small meshes, 22 fathoms long and  $2\frac{1}{2}$  fathoms deep, was used, and great care was taken to have the hauls made in exactly the same places and at the same season, the latter part of September, when the fish would have a length of from 2 to 4 inches, being agreed upon. The work was conducted by me, and controlled by an assistant to the fishery board, an implacable opponent to sea-fish hatching.

Two fjords, no. 1 and no. 2, were thus overhauled in September, 1903. In no. 1 fry were planted the following spring and both fjords again overhauled in September. In 1905 fry were planted in both fjords in April, after which they were overhauled in September the same year. Fjord no. 3 was investigated by me alone, and in the following manner: First, overhauling in September, 1904, with subsequent planting of fry in April, 1905; investigated in September same year. More fry planted in April, 1906, and a final overhauling the following September. As will be seen, all the fjords mentioned have been overhauled three times each. In the first and third, fry were planted twice, in the second only once. The results were as follows:

*Fjord No. 1.*—About 10 miles long, 1 mile broad, shaped like a horseshoe. Bottom of sand, clay, and mud, the shores mostly rock, covered with algæ,

while the small creeks where the hauls were made were covered with seaweed. One hundred and six hauls were made each time and with the following result: September, 1903, before planting, 426 yearlings; September, 1904, after planting, 1,523 yearlings; September, 1905, after planting, 1,133 yearlings.

*Fjord No. 2.*—About  $1\frac{1}{2}$  miles long by one-third of a mile broad. Bottom as in no. 1. Many of the small creeks liberally covered with sawdust. Twenty-one hauls each time, resulting as follows: September, 1903, before planting, 36 yearlings; September 1904, before planting, 133 yearlings; September, 1905, after planting, 143 yearlings.

*Fjord No. 3.*—Circular. Two and one-half miles long by 1 mile broad. Bottom as no. 1. Number of hauls 33, with following results: September, 1904, before planting, 454 yearlings; September, 1905, after planting, 756 yearlings; September, 1906, after planting, 953 yearlings.

The main results for the three fjords will be:

Fjord.	Before planting.	After planting.
No. 1.....	<i>Fry.</i> 426	<i>Fry.</i> <sup>a</sup> 1,328
No. 2.....	<sup>a</sup> 84	<sup>a</sup> 143
No. 3.....	454	<sup>a</sup> 855
Total.....	964	2,326

<sup>a</sup> Average.

The increase amounts to 141 per cent.

Figures taken from the fishery statistics for the Kristianiafjord, inside of Dribak, begun in 1872, show an average catch of 75,761 cod in the period between 1872 and 1881, and of 58,476 between 1882 and 1891. In 1892, when fry first were planted, the catch was 44,013. Since then there has been a steady increase, and last year the number caught was 114,013. The number of fry planted in the Kristianiafjord since 1892 is about 170,000,000, worth about 5,000 kroner, while the increase in the catch over and above what it was in 1892 is worth about 600,000 kroner.

On the west coast of Norway, where hatching has not been conducted, the cod is gradually disappearing from the fjords.





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